Cracking the Code: An Approach to Estimating Savings from Energy Codes

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California building codes have demonstrated significant impacts

(Source: California Energy Commission and 2009 California Residential Appliance Saturation Survey. Statewide)
Stringent codes raise the baseline—decreasing program benefits
Utilities ask: How can we recoup savings being “lost” to increasingly stringent codes?

(Source: PG&E Energy Efficiency Portfolios)
Today’s talk: How do we evaluate savings from building codes?

“An affected utility may count toward meeting the standard up to one third of the energy savings, resulting from energy efficiency building codes, that are quantified and reported through a measurement and evaluation study undertaken by the affected utility.”

- Codes program evaluation 101

- A few unique strategies
  - Scope/budget constraints
  - Focus on strategies rather MWh
  - No silver bullets

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Building codes pose unique evaluation challenges in Arizona

- What is the market?
  - new construction – com and res

- AZ is a home rule state:
  - Mix of IECC/ASHRAE vintages in 120+ jurisdictions
  - 4 different climate zones

(Source: AZ Cities @ Work)
The approach I describe today is a modified version of the California methodology.

C&S Advocacy Program Evaluation Protocol

Developing potential savings – similar to technical potential

**Unit Energy Use**

<table>
<thead>
<tr>
<th>Energy Consumption (KWh)</th>
<th>Pre code (KWh)</th>
<th>Post code (KWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60</td>
<td>40</td>
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**Savings = 20 kWh per unit over lifetime of the unit**

50,000 units \( \times \) installed per year = 100 MWh potential savings

**Potential Savings Snapshot (1 year)**

- Energy Savings (MWh): 120
- Energy Savings: 100
- Energy Savings: 80
- Energy Savings: 60
- Energy Savings: 40
- Energy Savings: 20
- Energy Savings: 0

**Potential Savings Over Time (2% Market Growth)**

- Energy Savings (MWh): 140
- Energy Savings: 120
- Energy Savings: 100
- Energy Savings: 80
- Energy Savings: 60
- Energy Savings: 40
- Energy Savings: 20
- Energy Savings: 0

Source: Navigant
The method removes various slices of savings from total potential savings.

- **Potential Code Savings**
- **Gross Code Savings**
- **Net Code Savings**
- **Non-PA Savings**
- **Net Program Savings**

Source: Navigant
A snapshot of the codes evaluation process over time

Source: Navigant

NOMAD = Naturally occurring market adoption rate
NOSAD = Naturally occurring standard adoption
Our model represents the multidimensional nature of the challenge.
Illustrative results from the model

![Graph showing net energy savings over project years for different sectors.](image)
Today I will share a few strategies associated with each step in C&S evaluation

- Potential: Market Size
- Gross: Compliance Rate
- Net: Naturally occurring standards adoption
- Net C&S Program: Interpretations of attribution
Potential savings calculation

\[ \sum (\text{New Meters} \times (\text{kWh/year}_{\text{old\ code}} - \text{kWh/year}_{\text{new\ code}})) \]

- Market size → new meter installations by
  - Jurisdiction
  - Climate zone
- UEC → energy simulation modeling
  - Baseline code models (res)
  - 16 DOE commercial prototype models (com)
- Home rule state
  - Mix of code vintages

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To verify new meters: we employed a three step process for each meter

- Draw a sample, then look up the site address using an online search engine

- Categorize as Energy Star building type
  - later matched on an EUI basis to the 16 DOE prototypes
  - Different from APS reported type in 12% of cases

- Determine building size and age
Example: Valid for claiming savings

- **Ex Ante:**
  - 2009 new meter
  - “restaurant” - APS
  - ? Sqft

- **Ex Post:**
  - 2009 confirmed
  - “quick service restaurant” – DOE
  - 2,455 sqft
Example: New meters in existing buildings

Ex Ante:
- 2013 new meter
- “office” - APS
- ? Sqft

Ex Post:
- 2006 – existing building
- “small office” – DOE
- 4,000 sqft
Example: No building

- **Ex Ante:**
  - 2009 new meter
  - “office” - APS
  - ? Sqft

- **Ex Post:**
  - No building, perhaps an irrigation pump?
Example: Empty lot – new construction?

☐ Ex Ante:
- 2013 new meter
- “retail int/ext entry” - APS
- ? Sqft

☐ Ex Post:
- Empty lot, evidence of construction activity
- Verify next year
Gross savings accounts for compliance

\[ kWh_{\text{new code}} + ((kWh_{\text{old code}} - kWh_{\text{new code}}) \times \text{Compliance Rate}) \]

- **Residential technique:**
  - Compliance training pre-test (in progress)
  - Billing analysis (in progress)
  - Drive by audit (potential future step)

- **Commercial technique:**
  - Remote audit or billing analysis to verify EUI (potential future step)
Compliance training “pre-test”
Net savings: NOMAD/NOSAD

- NOMAD – market adoption
  - Convene Delphi panel

- NOSAD – standards adoption
  - Utility can only claim savings for as long as the code is not superseded
  - 3 years for IECC and ASHRAE 90.1 in this case
Attribution—the sticky question

- In AZ, the ACC mandates a 1/3 discount to savings
- Argument for different attribution discounts for different jurisdictions
  - Federal
  - State
  - Local
Strategies to discuss on the cruise

Potential
- Remote verification
- Energy simulation

Gross
- Compliance training
- Pretest
- Billing analysis

Net
- 3-year rule

Attribution
- Differs by:
  - Federal
  - State
  - Local

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